

WHAT IS CLAIMED IS:

1. An image processing apparatus that processes a binary image, comprising:

5 an input unit that inputs the binary image as a multi-valued image;

a halftone dot image area map creating unit that searches for a halftone dot image area that may be in the multi-valued image and creates a halftone dot image area
10 map;

a line drawing/character area map creating unit that searches for a line drawing/character image area that may be in the multi-valued image and creates a line drawing/character image area map;

15 a halftone dot image binarizing unit that binarizes an input image corresponding to the halftone dot image area map while suppressing input read error that may occur when said input unit inputs the binary image, and generates a binarized halftone dot image;

20 a line drawing/character smoothing unit that smoothes a jaggy contained in an input image corresponding to the line drawing/character area map, and generates a binarized line drawing/character image; and

an image combining unit that combines the
25 binarized halftone dot image and the binarized line drawing/character image.

2. The image processing apparatus according to claim 1, wherein said halftone dot image area map creating unit lists and stores at least one of center-of-gravity information about centers of gravity of halftone dots and boundary box information as information about halftone dots in the halftone dot image area.

~~3. The image processing apparatus according to claim 2, wherein said halftone dot image area map creating unit calculates a halftone dot density in a given area by referring to the center-of-gravity information, and deletes corresponding information from the halftone dot image area map when the halftone dot density does not meet a given condition.~~

15 ~~4. The image processing apparatus according to claim 2, wherein said halftone dot image area map creating unit calculates a halftone dot density in one of blocks that correspond to a given area by referring to the center-of-gravity information about halftone dots in said one of the blocks and deletes corresponding information from the halftone dot image area map when the halftone dot density does not meet a given condition.~~

25 ~~5. The image processing apparatus according to claim 2, wherein said halftone dot image area map creating unit performs a first process of painting out a boundary~~

~~box and a second process of painting out a portion~~
~~expanding from the boundary box on the basis of the~~
~~boundary box information, the boundary box and the portion~~
~~that have been painted out being included in the binarized~~
5 halftone dot image.

6. The image processing apparatus according to
claim 5, wherein, when a gap pixel remains after the first
and second processes are performed for each of all the
10 center-of-gravity information, said halftone dot image
area map creating unit paints out the gap pixel when a
number of gap pixels is smaller than a predetermined
threshold value.

88-1
15 7. The image processing apparatus according to
claim 1, wherein said line drawing/character area map
creating unit detects a closed area from the multi-valued
image in order to create the line drawing/character area
map, said closed area corresponding to the line
20 drawing/character area.

8. The image processing apparatus according to
claim 1, wherein said halftone dot image binarizing unit
sets a proximity area close to a target pixel that is
25 included in the input image corresponding to the halftone
dot image area map and is to be binarized.

~~9. The image processing apparatus according to~~
claim 8, wherein said halftone dot image binarizing unit
adaptively determines a threshold value for binarization
on the basis of a distribution of pixel values in the
5 halftone dot image area.

10. The image processing apparatus according to
claim 8, wherein said halftone dot image binarizing unit
changes a value of the target pixel on the basis of the
10 distribution, a changed value of the target pixel being
used for binarization.

11. The image processing apparatus according to
claim 10, wherein, when said halftone dot image binarizing
unit detects an inclination in regard of pixel values on
the basis of distribution thereof, the halftone dot image
binarizing unit does not binarize the target pixel in the
absence of change of the value thereof.

12. The image processing apparatus according to
claim 10, wherein said halftone dot image binarizing unit
determines whether the value of the target pixel should be
increased or decreased on the basis of the distribution.

13. The image processing apparatus according to
claim 12, wherein said halftone dot image binarizing unit
calculates the changed value of the target pixel from a

maximum pixel value available in the halftone dot image
area when it is determined that the value of the target
pixel should be increased, and calculates the changed
value of the target pixel from a minimum pixel value
5 available in the halftone dot image area when it is
determined that the value of the target pixel should be
decreased.

14. The image processing apparatus according to
10 claim 10, wherein said halftone dot image binarizing unit
obtains a difference between the value of the target pixel
and the changed value thereof, and restrains the changed
value when the changed value is larger than a given
threshold value.

15
82C-1
15. The image processing apparatus according to
claim 10, wherein said halftone dot binarizing unit
binarizes original values of target pixels that are not
changed and changed values of other target pixels by using
20 a threshold value for binarization.

16. The image processing apparatus according to
claim 1, wherein said line drawing/character smoothing
unit counts a number of black pixels in each row or column
25 in a given area of the input image corresponding to the
line drawing/character area map, and detects the jaggy
contained in the input image on the basis of ratios of

~~black pixels between rows or columns.~~

17. The image processing apparatus according to claim 16 , wherein said line drawing/character smoothing unit sets a mask in the given area to count the number of black pixels in each row or column in said mask, and shifts the mask to count the number of black pixels only in a new row or column that is not included in the mask before shifting, so that the jaggy can be detected by the numbers of black pixels before and after the mask is shifted.

18. An image processing method that processes a binary image, comprising the steps of:

inputting the binary image as a multi-valued image;

searching for a halftone dot image area that may be in the multi-valued image and creating a halftone dot image area map;

searching for a line drawing/character image area that may be in the multi-valued image and creating a line drawing/character image area map;

binarizing an input image corresponding to the halftone dot image area map while suppressing input read error that may occur at the time of inputting the binary image and thus generating a binarized halftone dot image;

smoothing a jaggy that may be contained in an

~~input image corresponding to the line drawing/character~~

area map and thus generating a binarized line drawing/character image; and

combining the binarized halftone dot image and the binarized line drawing/character image.

8/25
CL/5